

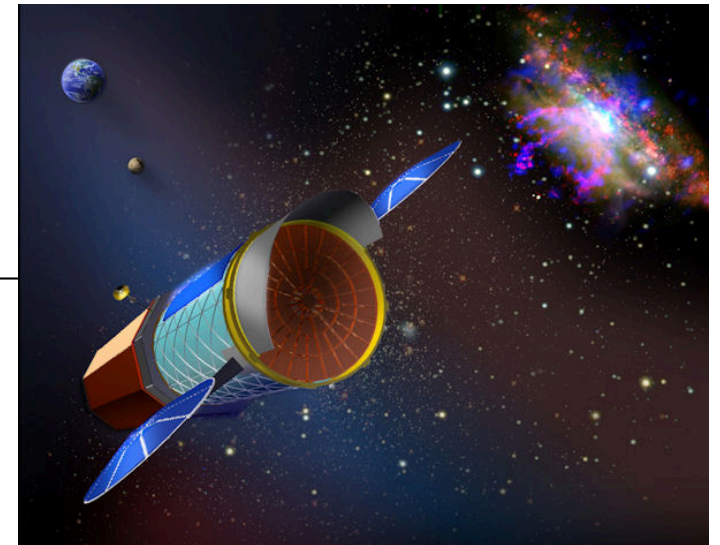
IXO Science Meeting/ April 27, 2010

NASA IXO Project Status

Jean Grady / GSFC

IXO NASA Project Manager

On behalf of IXO team

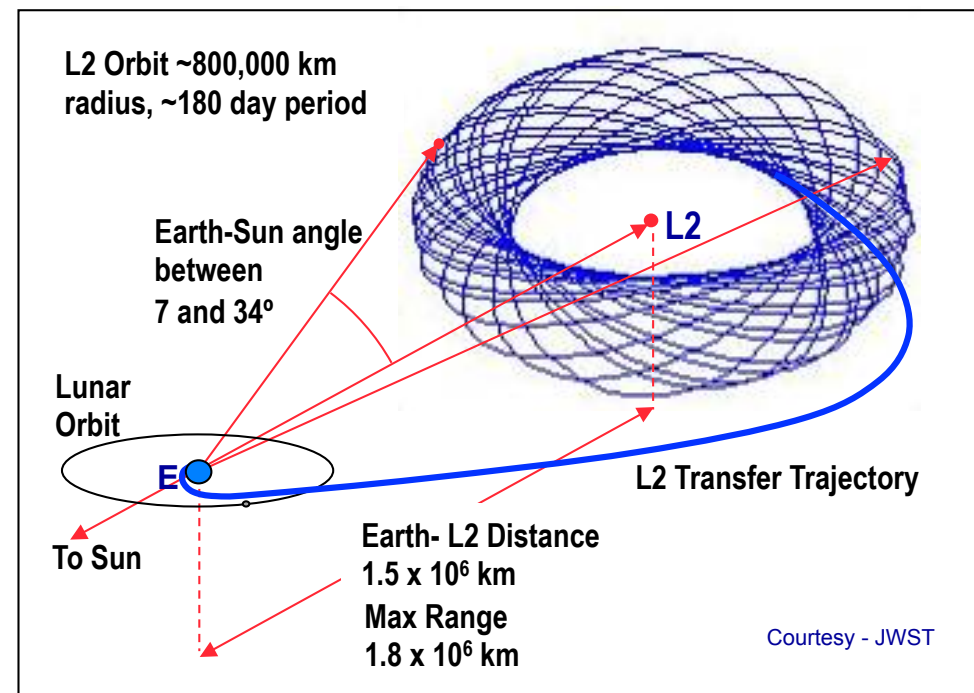
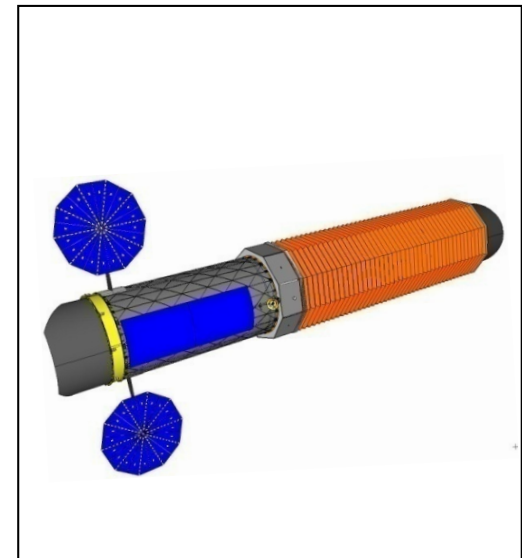


Highlights Since Last Full IXO Science Meeting (1/2009)

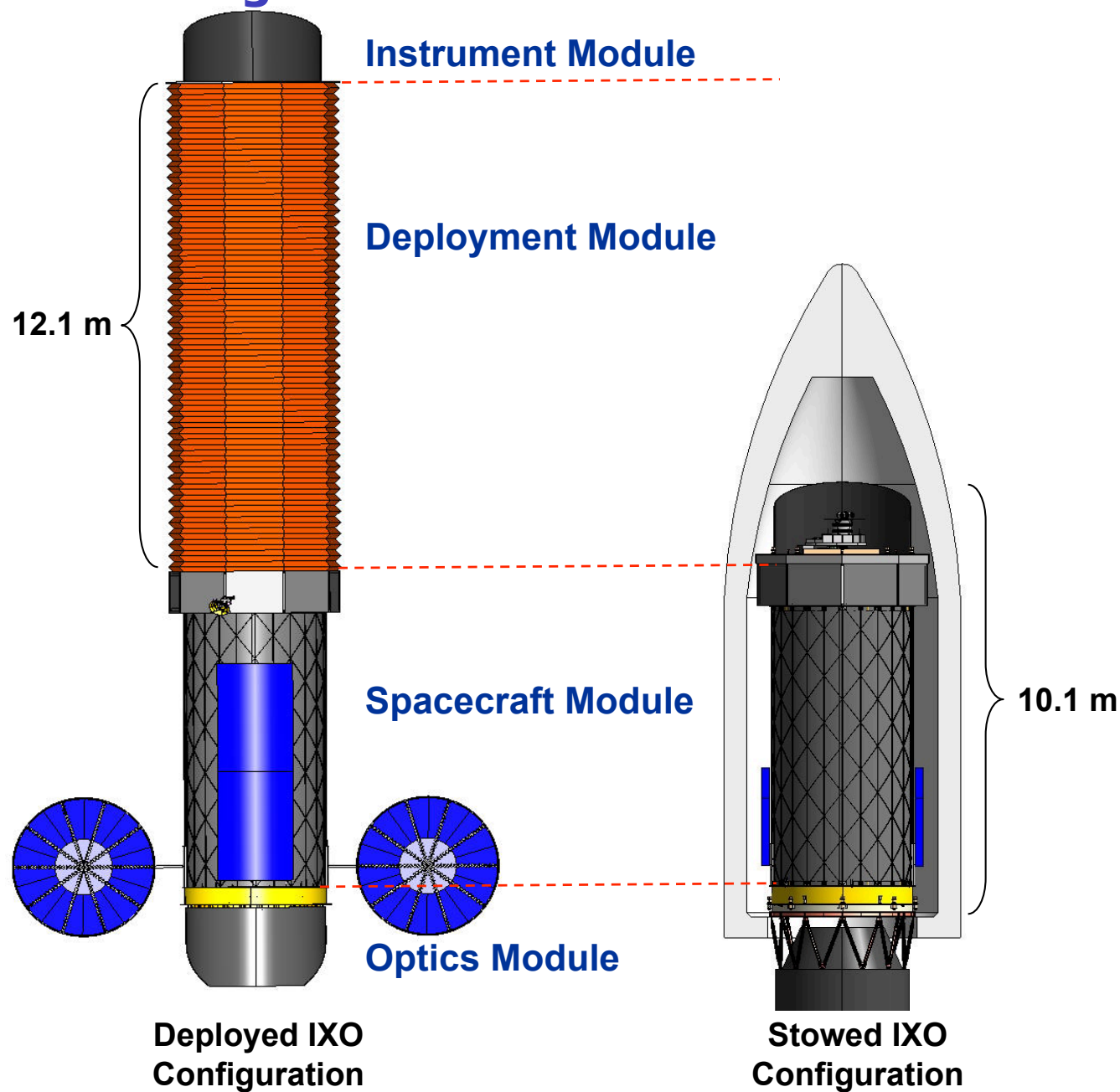
- Completed definition of NASA mission concept
- Held internal review of observatory and flight mirror assembly design concepts
- Reconciled project estimates with results of independent cost, schedule and technology estimate conducted by Aerospace Corporation
- Provided multiple submittals to the Astro2010 decadal committee, covering: science, instrumentation, technology development, spacecraft, operations, cost, schedule, programmatics, etc.
- Confirmed observatory design is compatible with significant options under consideration: launch vehicle, mirror technology type, grating options
- Supporting work for Cosmic Visions including instrument studies, mirror technology related documentation, etc.
- Segmented glass mirror technology demonstrated significant improvement in fabricated segments; precision mounting in process
- Transition Edge Sensor microcalorimeter technology making progress in both core and extended array technologies

Mission Overview

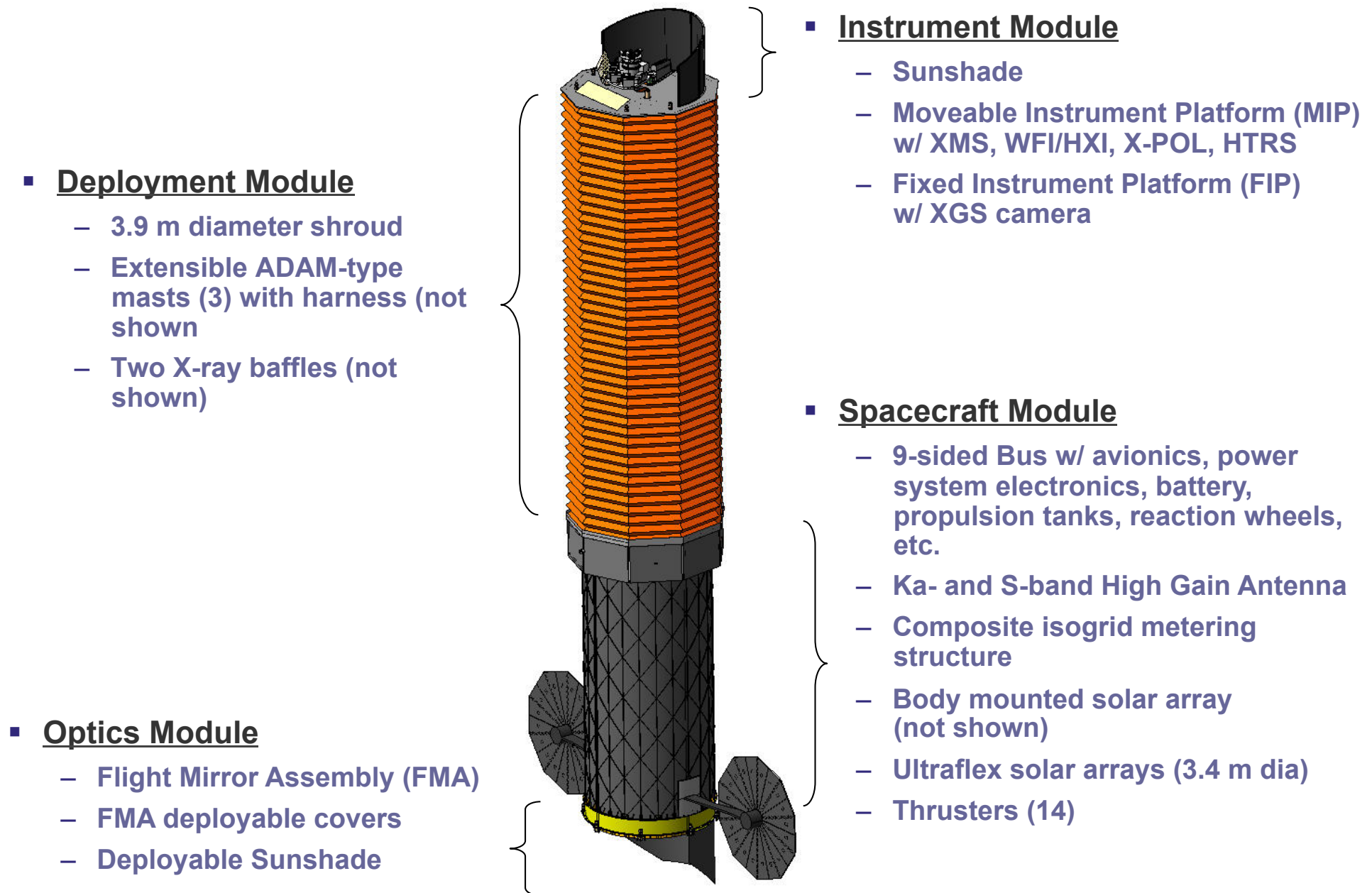
- **Single Telescope Configuration**
 - 3.4 m dia mirror with a 20 m focal length
 - Full focal length achieved with extensible metering structure
 - Multiple instruments share focus
- **Launch and Orbit Insertion**
 - Observatory compatible with either Atlas V or Ariane 5
 - Observatory Dry Mass is ~5850 kg (w/ ~40% overall contingency) within capability of Atlas V or Ariane 5
 - Direct launch into L2 orbit
 - 100 day cruise
- **Mission Orbit**
 - L2 800,000 km semi-major axis halo orbit
- **Mission Life and Sizing**
 - Class B Mission: no performance degradation w/ single point failure
 - Mission Life: 5 years required; consumables sized for 10 years



NASA Mission Design

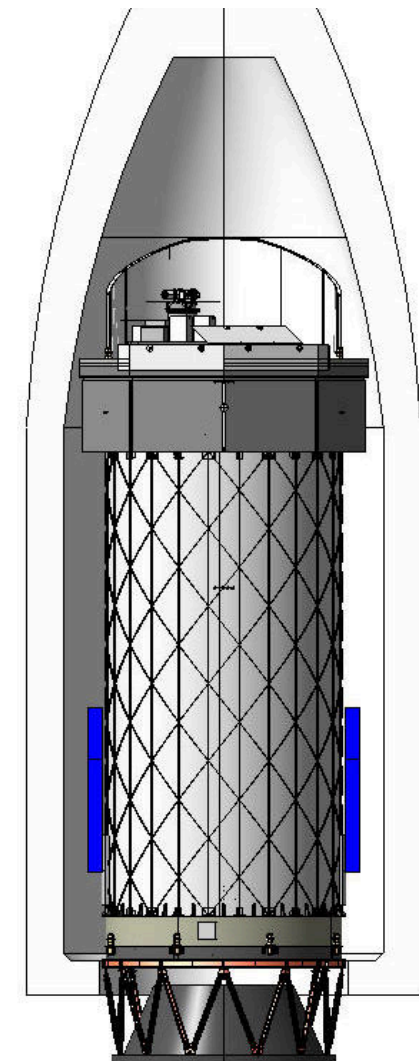


Observatory Module Overview



Mass Summary - Atlas V

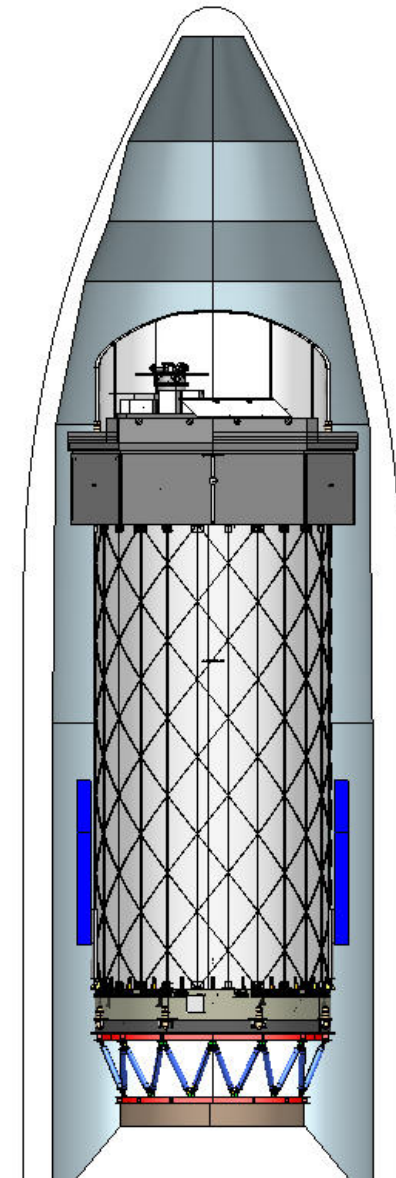
Item	Total CBE [kg]	Design Maturity Margin [%]	Total CBE with Margin [kg]
Structures and mechanisms	1784	15%	2049
Thermal control	279	20%	335
Propulsion (dry mass)	103	10%	113
AOCS	107	6%	114
Data Handling	60	22%	73
Telecommunications	32	5%	33
Power	178	11%	197
Stray light mitigation	165	18%	195
Payload accommodation equipment	4	7%	4
Spacecraft harness (2)	177	32%	234
Payload - focal plane instruments	494	24%	614
Payload - Mirror Glass	733	20%	843
Spacecraft adapter	62	15%	71
Spacecraft dry mass	4178	17%	4875
Total S/C dry mass w/ 20% system level margin	5850		
Propellant mass (including all margins)	240		
LV adapter	253.0	7%	268.0
Launch mass: S/C wet mass and LV adapter	6356		
Launcher mass constraint [kg]	6425		
Above/Below mass target by [kg]	-69		
Δmass [kg] (reserve)	1044		
Δmass [%] (reserve)	21%		



Good margins!

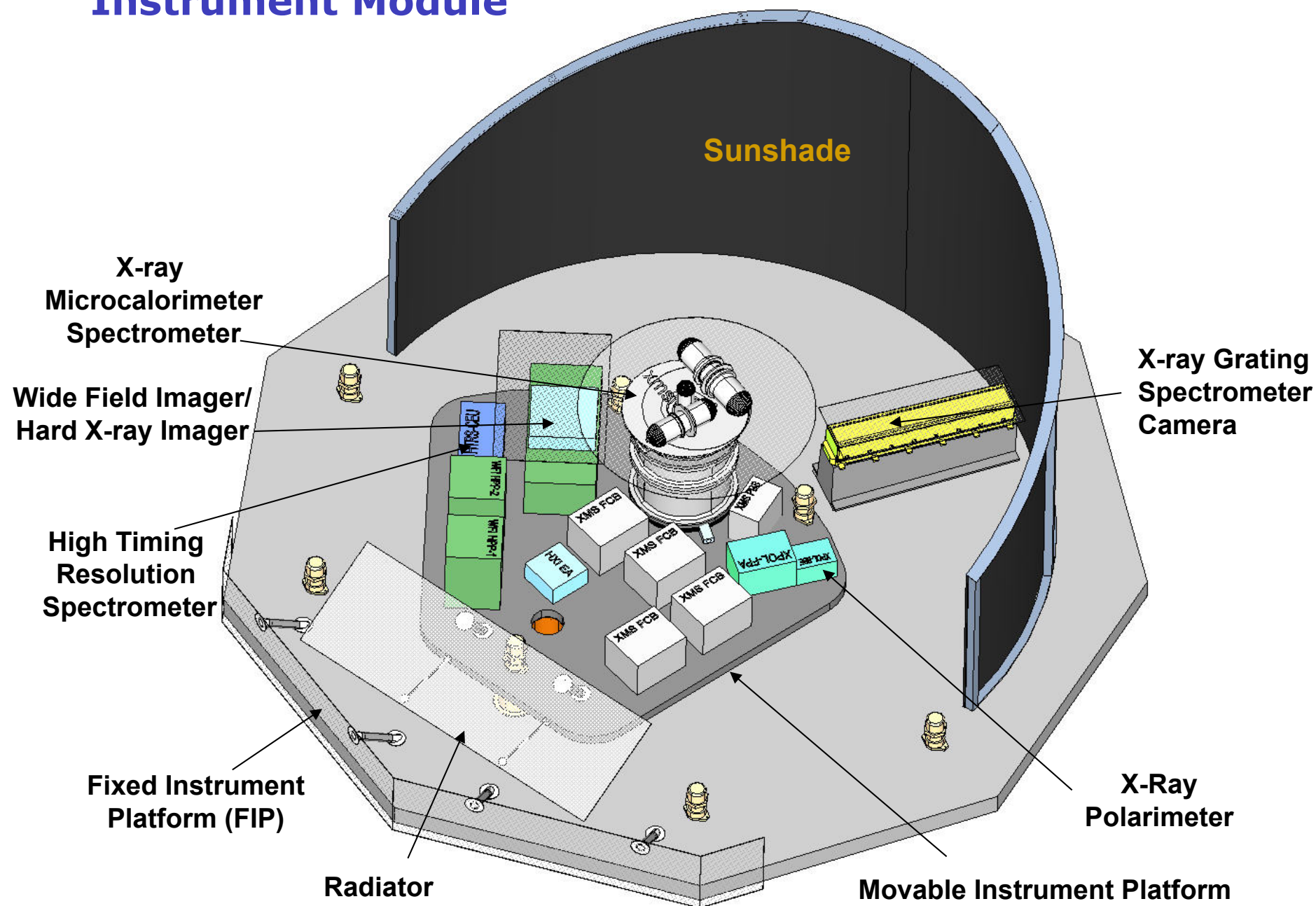
Mass Summary – Ariane 5

Item	Total CBE [kg]	Design Maturity Margin [%]	Total CBE with Margin [kg]
Structures and mechanisms	1784	15%	2049
Thermal control	279	20%	335
Propulsion (dry mass)	103	10%	113
AOCS	107	6%	114
Data Handling	60	22%	73
Telecommunications	32	5%	33
Power	178	11%	197
Stray light mitigation	165	18%	195
Payload accommodation equipment	4	7%	4
Spacecraft harness (2)	177	32%	234
Payload - focal plane instruments	494	24%	614
Payload - Mirror Glass	733	20%	843
Spacecraft adapter	62	15%	71
Spacecraft dry mass	4178	17%	4875
Total S/C dry mass w/ 20% system level margin	5850		
Propellant mass (including all margins)	318		
LV adapter	333.0	11%	369.0
Launch mass: S/C wet mass and LV adapter	6537		
Launcher mass constraint [kg]	6500		
Above/Below mass target by [kg]	37		
Δmass [kg] (reserve)	938		
Δmass [%] (reserve)	19%		



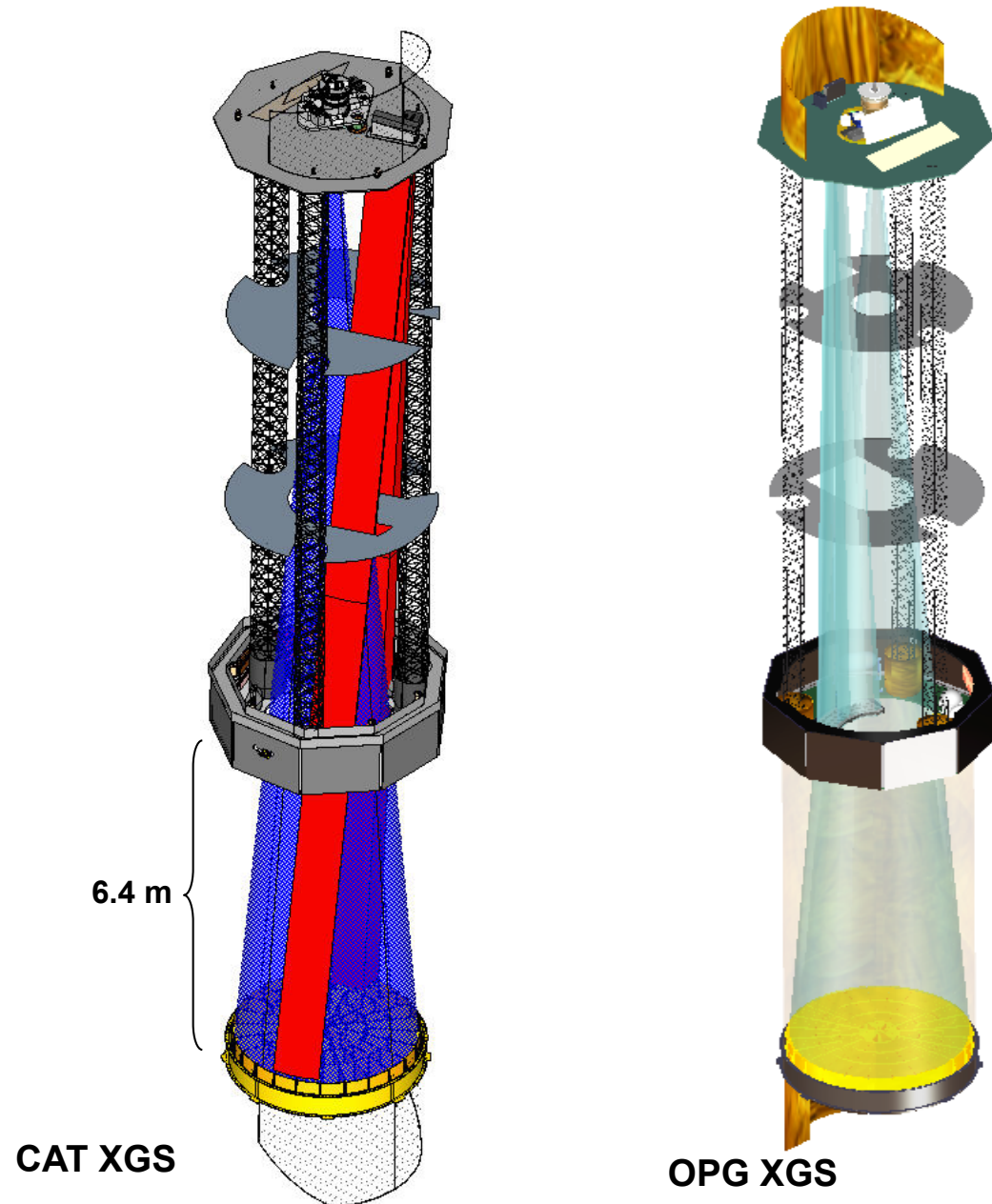
Almost!

Instrument Module

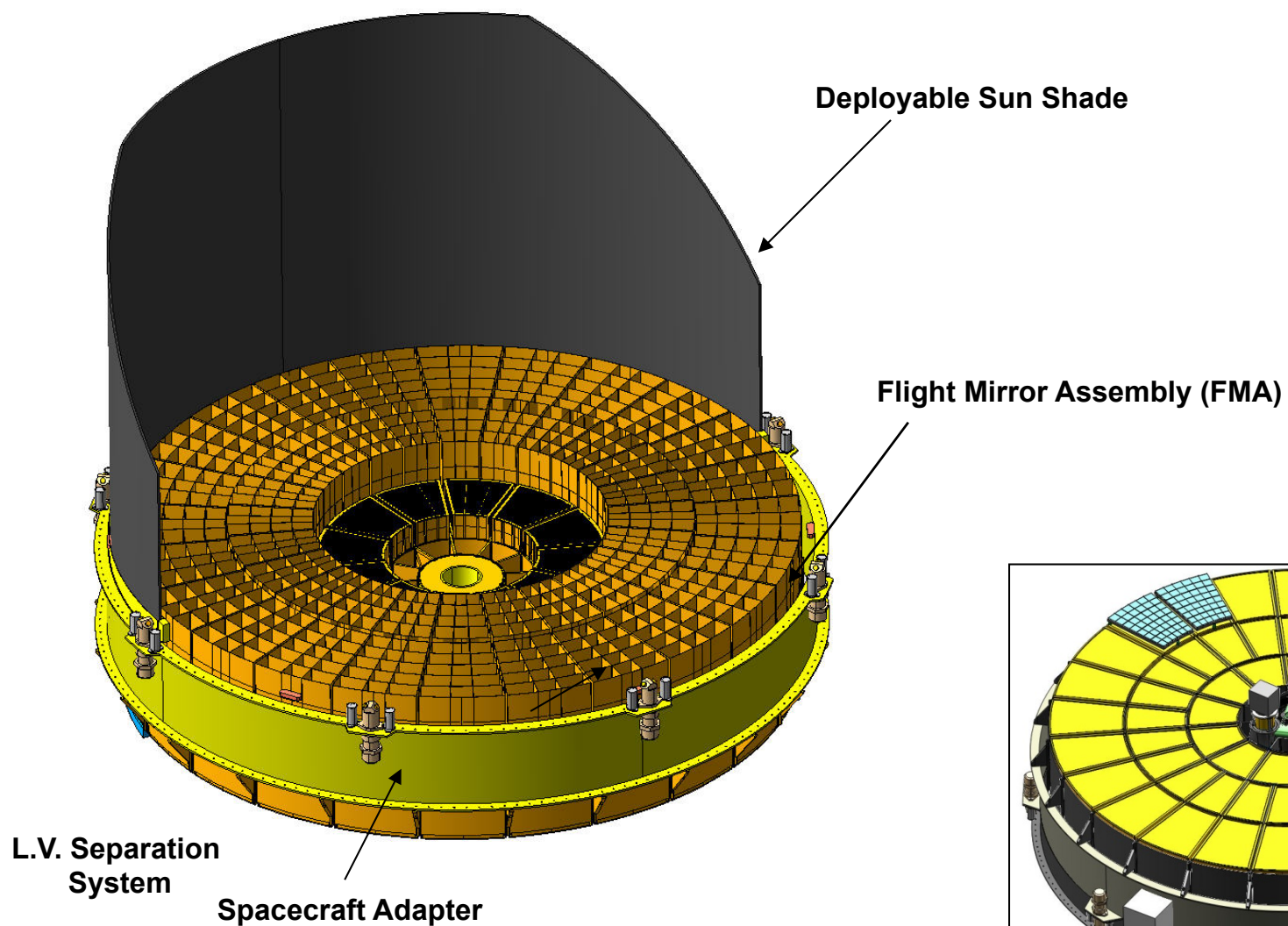


Observatory Accommodates Multiple Grating Concepts

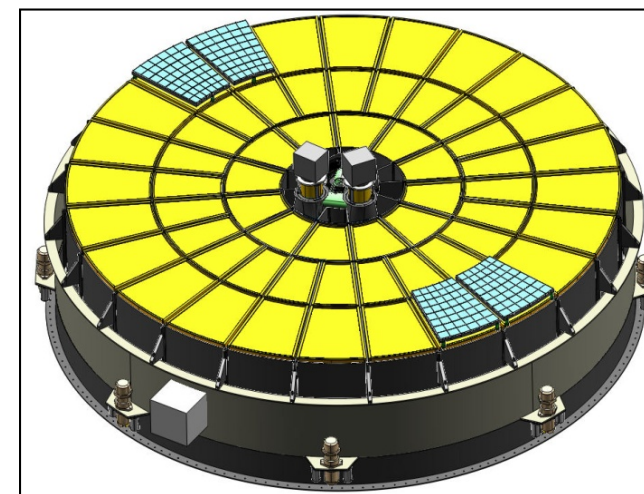
- The X-ray traces of the FMA and XGS traverse nearly the entire length of the observatory
- Either Critical Angle Transmission (CAT) grating or Off-Plane Grating (OPG) XGS can be accommodated
- X-ray beam size drives the inner circumference of the spacecraft bus “ring” and deployable metering structure



Optics Module (Shown with Segmented Glass FMA)



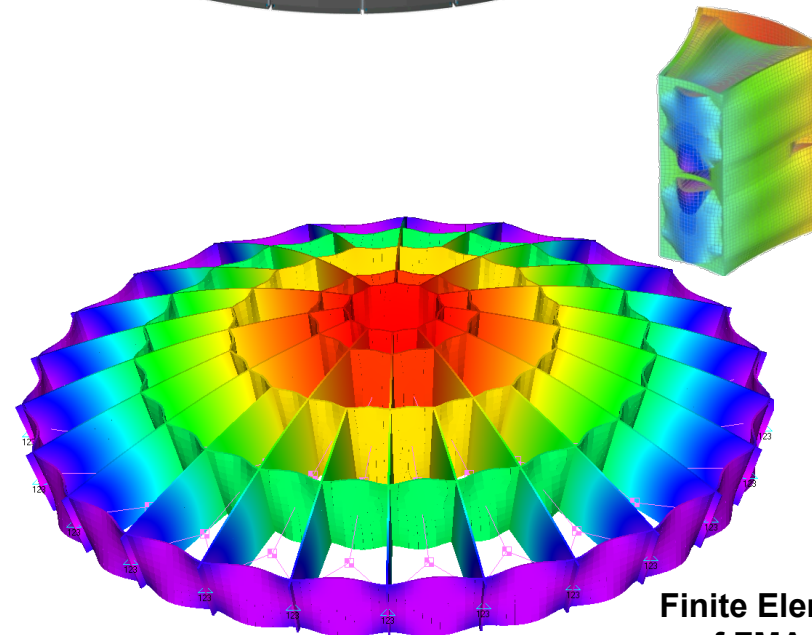
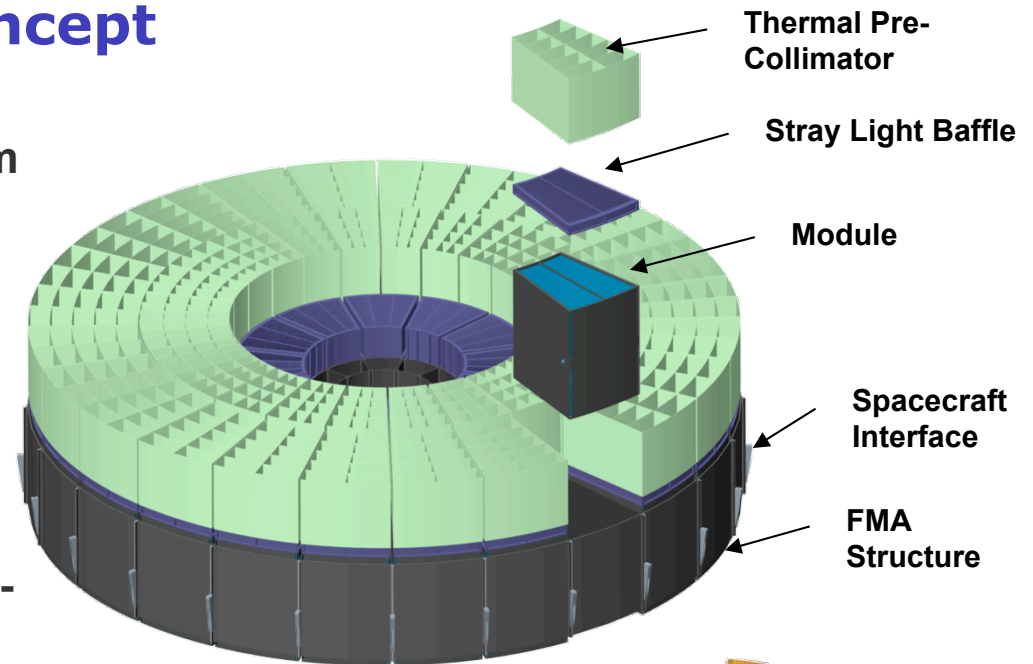
FMA interior and exterior covers not shown



View from interior, with CAT gratings shown

Segmented Glass FMA Concept

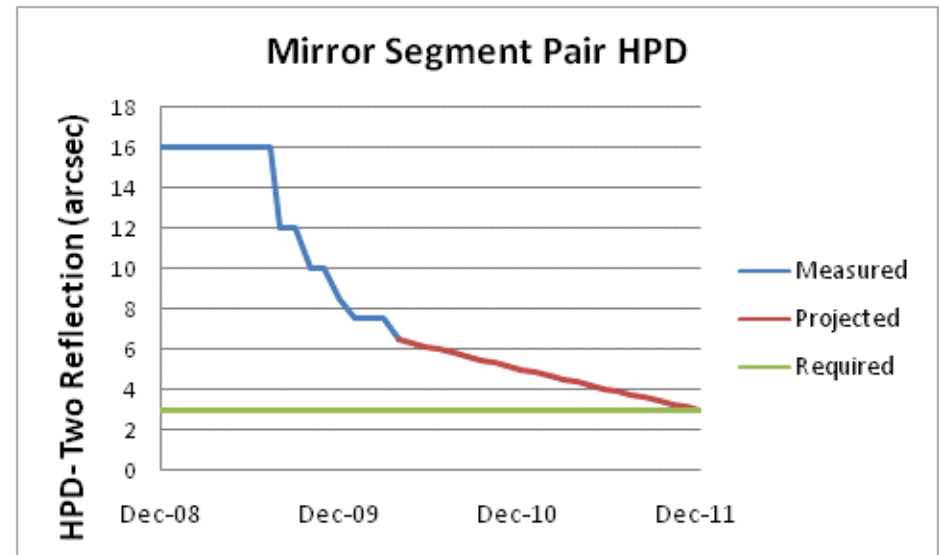
- Overall dimensions: 3.4 m dia x 0.8 m
- Segmented Wolter I optical design
- Slumped glass mirror segments
- 60 soft X-ray modules:
 - 24 outer, 24 middle, 12 inner
 - Each module with 200-300 segments
- Hard X-ray mirror module, with multi-layer coated mirrors, in the center provides high energy response
- Total FMA mass is ~2000 kg (current best estimate plus contingency)
- Power is ~1450 W to maintain 20 C
- Finite Element Analyses support design concept



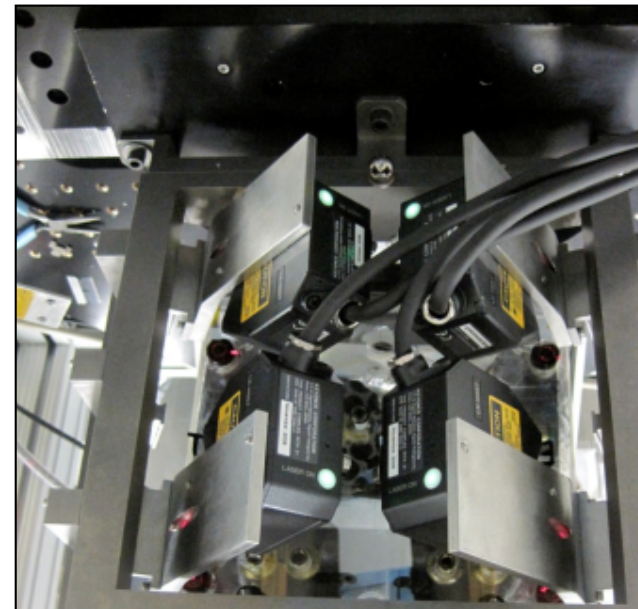
Finite Element Model of FMA Structure

Segmented Glass Mirror Technology

- **Mirror Segment Fabrication**
 - Achieved 6.5 arcsec Half Power Diameter (HPD) on most recent segments
 - Results due to improved mandrel figure and mandrel surface treatment
- **Mirror Alignment and Mount**
 - Two mounting techniques in development
 - Precision bonding demonstrated
 - Required alignment demonstrated
- **TRL – 4 milestone expected June 2010**
- **Mirror technology plans, requirements, interfaces, etc. in update to support Cosmic Visions**



Mirror fabrication on track to meet angular resolution requirements in 2011



Precision displacement sensors (4) on the mirror housing simulator

TES Microcalorimeter Technology

■ Inner Array

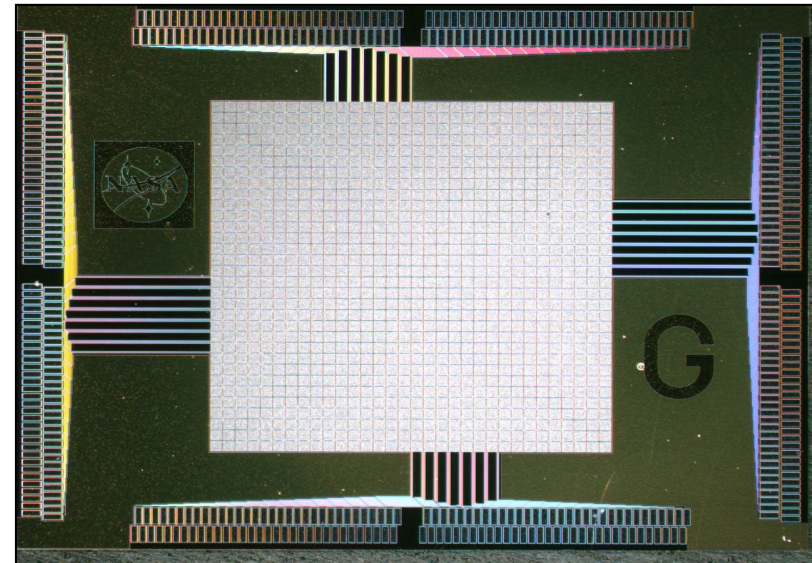
- Fabricated 32 x 32 TES arrays with and without micro-strip wiring; fab process refinement ongoing
- Test Platform for 32 x 3 demo in process
- 32 x 3 demo to establish TRL 5 expected by summer 2010

■ Outer Array (extended FOV)

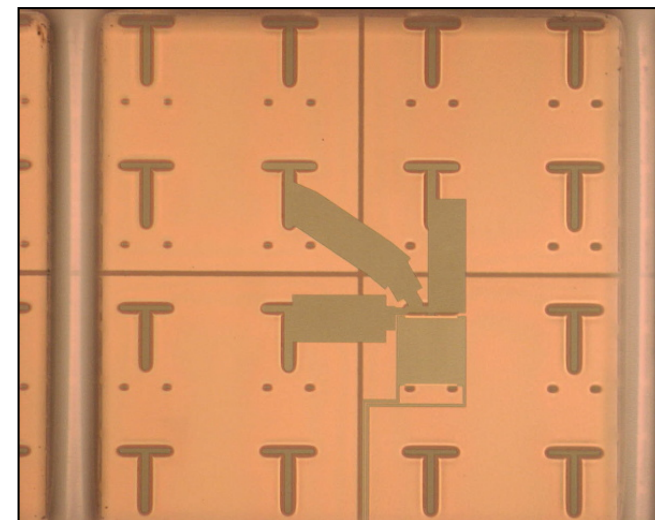
- Produced first test devices to probe the trade space for the XMS outer array.
- These cover 4x more area per TES.

■ Supporting instrument studies

- Detector, multiplexing, and focal plane assembly trades
- Cooler options



32 x 32 TES array



TES outer array test devices

[illegible]

Summary

- Mission concept for IXO is robust
- NASA team supporting Cosmic Visions preparations
- Key technologies making great progress

